

Claims

1. A fuel cell power plant, comprising:
  - a plurality of fuel cells serially connected in a stack having a pair of external circuit output terminals;
  - a voltage limiting auxiliary load, disposed to dissipate heat in an element of said fuel cell power plant so as to raise the temperature of said element;
  - 5 a switch connected in series with said auxiliary load between said terminals; and
  - switch control means operable during fuel cell stack operation transitions selected from startup and shutdown for causing said switch to alternatively (a) connect said auxiliary load between said terminals, (b) disconnect said auxiliary load from at least one of said terminals, repetitively during at least one of said transitions, in response to electrical output of said fuel cell stack, and operable
  - 10 during periods of time exclusive of start up and shutdown in response to temperature resulting from heat dissipated by said auxiliary load in said element.
2. A fuel cell power plant, comprising:
  - a plurality of fuel cells serially connected in a stack having a pair of external circuit output terminals;
  - a voltage limiting auxiliary load;
  - 5 a switch connected in series with said auxiliary load between said terminals; and
  - switch control means operable during fuel cell stack operation transitions selected from startup and shutdown for causing said switch to alternatively (a) connect said auxiliary load between said

10      terminals and (b) disconnect said auxiliary load from at least one of said terminals, repetitively during at least one of said transitions.

3.      A power plant according to claim 2 wherein:  
said switch control means is operable in response to electrical output of said fuel cell stack.
4.      A power plant according to claim 2 wherein:  
said switch control means comprises pulse width modulation responsive to a function of the voltage across said terminals.
5.      A power plant according to claim 4 wherein:  
said function is at least one schedule of desired duty cycle as function of the voltage across said terminal.
6.      A power plant according to claim 5 wherein:  
said function is a first schedule during startup and a second schedule, different from said first schedule, during shutdown.
7.      A power plant according to claim 4 wherein:  
said switch control means limits said duty cycle in response to a function of power dissipated in said auxiliary load.
8.      A power plant according to claim 2 wherein:  
said switch control means limits the amount of time that said switch connects said auxiliary load between said terminals in response to a function of power dissipated in said auxiliary load.

9. A power plant according to claim 3 wherein:  
said switch control means causes said switch to connect said auxiliary load between said terminals in response to the voltage across said terminals reaching 0.4 volts per cell; and

5 said switch control means causes said switch to disconnect said auxiliary from at least one of said terminals in response to the voltage across said terminals reaching 0.0 volts per cell.

10. A power plant according to claim 3 wherein:  
said switch control means causes said switch to connect said auxiliary load between said terminals in response to the voltage across said terminals reaching 0.2 volts per cell; and

5 said switch control means causes said switch to disconnect said auxiliary from at least one of said terminals in response to the voltage across said terminals reaching 0.1 volts per cell.

11. A power plant according to claim 2 further comprising:

temperature means for providing a signal indicative of the temperature of said auxiliary load; and wherein:

5 said switch control means limits the amount of time that said switch connects said auxiliary load between said terminals in response to said signal indicating a temperature in excess of a threshold temperature.

12. A power plant according to claim 2 wherein:  
said switch control means causes said switch to connect said auxiliary load between said terminals in response to the voltage across said terminals reaching an upper limit voltage and causes said

5 switch to disconnect said auxiliary load from at least one of said terminals in response to the voltage across said terminals reaching a lower limit voltage.

13. A power plant according to claim 12 wherein:  
said upper voltage limit is 0.4 volts per cell and said lower voltage limit is 0.0 volts per cell.

14. A power plant according to claim 12 wherein:  
said upper voltage limit is 0.2 volts per cell and said lower voltage limit is 0.1 volts per cell.

15. A fuel cell power plant, comprising:  
a plurality of fuel cells serially connected in a stack having a pair of external circuit output terminals;  
a voltage limiting auxiliary load, disposed to dissipate heat in  
5 an element of said fuel cell power plant so as to raise the temperature of said stack;  
a switch connected in series with said auxiliary load between said terminals; and  
switch control means operable to control said switch (a) during transitions selected from startup and shut down in response to electrical output of said fuel cell stack and (b) during periods of time 10 exclusive of start up and shut down in response to temperature resulting from heat dissipated by said auxiliary load in said element.

16. A power plant according to claim 15 wherein:  
said element is a water accumulator in said fuel cell power plant.

17. A power plant according to claim 15 wherein:  
said element conducts oxidant toward said fuel cell stack.
18. A power plant according to claim 15 wherein:  
said element is an enthalpy recovery device in said fuel cell  
power plant.
19. A power plant according to claim 18 wherein:  
said auxiliary load comprises conductive graphite composite  
plates in said enthalpy recovery device.